

Claims

1. A method for evaluating or quantifying the prebiotic capability of a fiber or for identifying a prebiotic substance, which comprises

- (a) a step of evaluating or quantifying the effect by the tested fiber or substance on the growth and/or modification of a faecal bacterial population, and
- (b) a step of quantifying at least one product resulting from the fermentation of the tested fiber or substance and/or a step of quantifying the rate of assimilation of the tested fiber or substance.

2. A method for evaluating or quantifying the prebiotic capability of a fiber or for identifying a prebiotic substance, which comprises

- (a) a step of evaluating or quantifying the stimulation by the tested fiber or substance on the growth and/or modification of a faecal bacterial population,
- (b) a step of quantifying at least one product resulting from the fermentation of the tested fiber or substance,
- (c) a step of quantifying the rate of assimilation of the tested fiber or substance,
- (d) a step of calculating the Measure of the Prebiotic Effect (MPE) using the following equation:

$$\frac{1}{2} \sqrt{x^2 y^2 + x^2 z^2 + y^2 z^2} = MPE$$

wherein x is the value as determined in step (a), y is the value as determined in step (b) and z is the value as determined in step (c), and

- (e) a step of evaluating or quantifying the prebiotic capability of the tested fiber or substance as a function of the MPE.

3. The method according to claim 1 or claim 2 which comprises

- (a) incubating the faecal bacterial culture in the presence of the tested fiber or substance, and
- (b) determining the total amount and/or maximum growth rate of the beneficial faecal bacteria population, and
- (c) evaluating or quantifying the effect on the growth and/or modification of the faecal bacterial population as a function of the value as determined in step (b).

4. The method according to claim 1 or claim 2 which comprises
- (a) incubating the faecal bacterial culture in the presence of the tested fiber or substance,
 - (b) determining the total amount or total maximum growth rate of the beneficial faecal bacteria populations, and the total amount or total maximum growth rate of the non beneficial faecal bacteria populations,
 - (c) subtracting the total amount or total maximum growth rate of the non beneficial faecal bacteria populations from the amount or total maximum growth rate of the beneficial faecal bacteria populations to produce a Prebiotic Index, and
 - (d) evaluating or quantifying the effect on the growth and/or modification of the faecal bacterial population as a function of the Prebiotic Index.

5. The method according to claim 4 wherein the identification and quantification of the Prebiotic Index (PI) is defined by the following equation:

$$PI = \mu_{\max} B + \mu_{\max} L + \mu_{\max} E - \mu_{\max} Ba - \mu_{\max} Cl - \mu_{\max} Co - \mu_{\max} SRB;$$

wherein PI = prebiotic index; μ_{\max} = maximum growth rates of faecal bacteria in presence of the tested fiber; B = bifidobacteria, L = lactobacilli, E = eubacteria, Ba = bacteroides, Cl = clostridia, Co = coliforms, and SRB = Sulfate Reducing bacteria.

6. The method according to claim 1 or claim 2 which comprises
- (a) incubating the faecal bacterial culture in parallel in the presence and in the absence of the tested fiber or substance,
 - (b) after a certain incubation period, for instance 24 hours, determining the amount or maximum growth rate of the faecal bacteria in the culture in the presence and in the absence of the tested fiber,
 - (c) subtracting the amount or maximum growth rate of the faecal bacteria in the absence of the tested fiber from the amount or maximum growth rate of the faecal bacteria in the presence of the tested fiber, and
 - (d) evaluating or quantifying the effect on the growth and/or modification of the faecal bacterial population as a function of the value as determined in step (c).

7. The method according to claim 1 or claim 2 which comprises
- (a) incubating the same faecal bacterial culture in the presence and in the absence of the tested fiber,

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- (b) determining the amount or maximum growth rate of the beneficial faecal bacteria in the presence and in the absence of the tested fiber,
- (c) subtracting the amount or maximum growth rate of the beneficial faecal bacteria in the absence of the tested fiber from the amount or maximum growth rate of the beneficial faecal bacteria in the presence of the tested fiber,
- (d) determining the amount of the non beneficial faecal bacteria in presence and in the absence of the tested fiber,
- (e) subtracting the amount or maximum growth rate of the non beneficial faecal bacteria in the absence of the tested fiber from the amount or maximum growth rate of the non beneficial faecal bacteria in the presence of the tested fiber,
- (f) subtracting the value as determined in step (e) from the value as determined in step (c) to produce a Prebiotic Index, and
- (g) evaluating or quantifying the effect on the growth and/or modification of the faecal bacterial population prebiotic as a function of the Prebiotic Index.

8. The method according to any preceding claim wherein the beneficial faecal bacteria is at least one of bifidobacteria, lactobacilli and eubacteria.

9. The method according to any preceding claim wherein the non beneficial faecal bacteria is at least one of bacteroides, clostridia, coliforms and Sulfate Reducing bacteria.

10. The method according to any preceding claim wherein the product resulting from the fermentation of the tested fiber or substance which is quantified is a fermentation end product, for example at least one short chain fatty acid (SCFA), and optionally wherein the quantification of the fermentation end products is calculated through the ratio of lactic acid production over the total SCFA production.

11. The method according to claim 10 wherein the quantification of the fermentation end products is calculated through the ratio of lactic acid production over the production of acetate, butyrate, propionate and lactate.

12. The method according to any preceding claim wherein the maximum assimilation rate of the tested fiber or substance is calculated.

13. The method according to any preceding claim wherein the faecal bacteria population is analyzed by fluorescence *in situ* hybridization.
14. A method according to any preceding claim which comprises a step of comparing the prebiotic capability of the tested fiber or substance to the effect of a known prebiotic tested in the same conditions, for example fructooligosaccharide.
15. A method for designing a nutritional or pharmaceutical composition containing a prebiotic, which method comprises the steps of
- (a) evaluating, and optionally quantifying, the prebiotic capability of a fiber with the method of any one of claims 1 to 14,
 - (b) selecting at least one fiber having a good prebiotic capability, e.g. comparable to the prebiotic activity of a known prebiotic, and
 - (c) formulating a nutritional or pharmaceutical composition comprising the prebiotic selected in step (b) and a nutritionally or pharmaceutically acceptable carrier.
16. A system for designing a nutritional or pharmaceutical composition containing a prebiotic and delivering said nutritional or pharmaceutical composition to an individual in need thereof, which system comprises
- (a) means for quantifying the effect of a fiber on faecal bacteria and identification of a prebiotic,
 - (b) means for formulating a nutritional or pharmaceutical composition comprising the prebiotic identified in step (a) and a nutritionally or pharmaceutically acceptable carrier, and
 - (c) means for providing the nutritional or pharmaceutical composition obtained in step (b) to an individual in need thereof.
17. A system according to claim 16 wherein the means (a) are based on the method of any one of claims 1 to 14.
18. The method according to claim 15 or the system according to claim 16 or claim 17 wherein the tested fiber is fructooligosaccharide, glucooligosaccharide, pecticoligosaccharide, galactooligosaccharide, soyoligosaccharide, isomaltooligosaccharide, guar gum, hydrolyzed guar gum and/or mixtures thereof.

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19. A nutritional or pharmaceutical composition susceptible to be designed by a method according to claim 15 or a system according to claim 16 or claim 17.